VIRTUAL IRON BIRD

ENGINEERING FOR COMPLEX SYSTEMS

CHALLENGES

- Visualizing and communicating complex systems
- Corporate knowledge loss
- Effective what-if analysis tools

OBJECTIVES

Knowledge-integrating virtual vehicles & process models integrate key information from many sources, helping users to develop a 'big picture' understanding of design and operational tradeoffs.

Develop a component architecture/toolkit for building knowledge- integrating virtual vehicles; Develop and demonstrate components in use by enterprise customers:

- behavioral trade tool for the ISS vehicle system engineers, linked to backing docs and telemetry
- risk-advised maintenance process for orbiter processing
- process and tool suite for migrating legacy CAD and developing as-built models
- collaborate with industry and evaluate future options, such as simulation-based procurement

CUSTOMERS & COLLABORATORS

Currently customers and collaborators are:

- Shuttle Program
- ISS Vehicle Integrated Performance, Environments and Resources Team
- JSC EVA Program Office

CONTACT INFORMATION

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IMPACTS

The systems supporting manned spaceflight are among the most complex engineered systems ever created. As a result, communication and coordinated decision-making are critical problems for NASA and its contractors, and the overall technology ensemble for all large engineering organizations.

The ECS Virtual Iron Bird project will improve NASA's ability to make coordinated engineering decisions by developing ways to integrate engineering knowledge with fast-time simulations for decision-makers at many levels in the organization.

TECHNOLOGIES USED

A Virtual Iron Bird (VIB) is a computer-based model of vehicle structure (where are the parts and how are they connected?), function (what roles do they play?), component behavior (how do outputs relate to inputs? how do they fail), and operational procedures (what is the validated action sequence for doing X?). The VIB project complements and extends the Lifecycle Data Management (LDM) Systems currently being installed at NASA centers. These important systems are information libraries. The VIB project is working to turn them into tools for better thinking through these steps:

- Provide a formal semantic foundation for integrating models across the organization
- Prototype by building models to show integration across significant shuttle and station datasets
- Demonstrate utility by partnering with the Shuttle and Station programs to build and use applications with these integrated datasets, effectively leveraging these programs as test beds for new engineering tools and processes
- Lock in advances by partnering with industry and influencing NASA procurement policy

Some VIB components are already in use. Laser scanning technology for creating as-built geometry models of the orbiters was used to support the CAIB reconstruction of the Columbia debris by registering critical RCC panels and TPS tiles against orbiter geometry. An ISS geometry and environment simulation tool is in daily use by the ISS VIPER team to perform rapid, what-if analysis; three additional components will be in use by the end of FY04.